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PRINTABLE SHELF LABEL

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PRINTABLE SHELF LABEL

FIELD OF THE INVENTION

The present invention relates to an electronic shelf label assembly having as rewritable display and a printable overlay.

BACKGROUND OF THE INVENTION

Electronic shelf labels are becoming a popular and intelligent way to display product information on a shelf. The customer benefits by having all the information they need about the product, and the retailer benefits by having programmable information that can be readily changed by various electronic means. For example, prices can be kept up to date without printing new price changes. More permanent information can be printed on another portion of the electronic shelf label, such as a removable or permanent overlay that allows the electronic display to show through.

Exemplary electronic shelf labels as discussed above are shown and described in U.S. Pat. No. 5,111,196 issued to Hunt, U.S. Pat. No. 5,619,416 issued to Kosarew, U.S. Pat. No. 6,217,966 issued to Finster et al., and U.S. Pat. No. 6,552,663 issued to Swartzel et al. These patents describe electronic shelf labels that include a liquid crystal display, a mounting support, onboard electronics, a printable overlay, and a power source to provide viewability of the display at all times. One problem with the aforementioned devices is the need of a continuous power source and replacement of said power source on a regular basis. Without the power source, the display is blank.

To overcome the above problem, a bistable liquid crystal display that retains written information on the display in the absence of power can be used. One such electronic shelf label is shown and described in U.S. Pats. Nos. 5,751,257 and 6,253,190, both issued to Sutherland, which describe a system including an electronic shelf label having a bistable liquid crystal display for displaying price data and a Universal Product Code ("UPC") bar code, wherein the information programmed in the display remains on the display in the absence

of power. The shelf label has a set of synchronizing indicators and corresponding electrical contacts on the front side of the display, which are capable of interacting with a hand-held device that is connected to a central computer that contains inventory and price information. The hand held device can be used to read the UPC bar code on the shelf label and update or write corresponding price information on the label. Both the UPC and the price information are shown on the display.

Including the UPC as a writable element on the shelf label significantly increases the complexity and cost of the shelf label. The resolution needed to produce UPC information requires 113 modules of data, and therefore a corresponding number of contacts on the front of the display. The UPC for a product typically does not change over the life of the product. Other static information, for example, a human readable description of the product, a unit identification (e.g. per oz. or per 100 sheets), or the like, can also be desirable on the display. The placement of static information such as the UPC in writable form on the shelf label unnecessarily complicates the display structure of the label.

One solution to the aforementioned problem is shown and described in U.S. Pat. No. 6,637,650 issued to Capurso et al. It describes an electronic shelf label including a bistable liquid crystal display, which displays information even in the absence of power. A printable overlay containing the bistable liquid display is provided on a printable overlay sheet. The retailer can print static information on the overlay sheet, peel off the overlay containing the display, and attach it to a support. The support provides electrical continuity to the display by way of conductive adhesive and embedded conductive strips. Once attached to the conductive adhesive, the embedded conductive strips in the support provide a front contact outside the overlay area for electronic interfacing in order to change the information on the display. However, careful alignment of the overlay with the embedded conductive strips in the support is required to provide power to the display. Further, because the display is part of the overlay, and is not powered as provided to the retailer, it is difficult to test the functionality of the display before assembly with the support.

There is a need for a shelf label having a conductively mounted display wherein the functionality of a support for the display and the display can be tested prior to reaching the retailer, and wherein static information can be provided separately from the display, for example, on an overlay.

SUMMARY OF THE INVENTION

An electronic shelf label assembly and a method of making the same is described, wherein the assembly includes a support, a display, and a printable overlay. The support has a display area, an overlay area adjacent the display area, an exposed area adjacent the overlay area, and a plurality of conductive contacts, wherein each of the plurality of conductive contacts has a first conductive portion within the display area and a second conductive portion in the exposed area. The display has a substrate, and a plurality of electrically conductive contact pads on the substrate. The display is attached to the display area of the support such that the first conductive portion of the conductive contacts of the support contact the electrically conductive contact pads of the display. The printable overlay has a window, and is attached to the overlay area of the support such that at least a portion of the display in the display area of the support is viewable through the window.

ADVANTAGES

The electronic shelf label assembly allows for pre-testing of the support and display prior to sale, updating of static information without effecting the display, updating of the display without effecting the static information, and viewing of the display information in the absence of power.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a front view of a character display;

Fig. 2 is a cross sectional view of a character display taken along lines 2-2 in Fig. 1;

Fig. 3 is a front perspective view of a support with conductive strips inset into a surface of the support;

Fig. 4 is a perspective view of the front of a support having conductive strips inset into a surface of the support and conductive tape strips with adhesive backer liner positioned over the conductive strips;

Fig. 5 is a perspective view of a support assembly, including a support and character displays attached to the support;

Fig. 6 is a front view of a printable sheet with individual labels positioned in an array;

Fig.7 is an exploded view of a shelf label assembly, including a printable overlay and support assembly;

Fig. 8 is an exploded section view along line 8-8 of Fig. 7;

Fig. 9 is a shelf label assembly; and

Fig. 10 is a back perspective view of a shelf label assembly having a bracket for attaching the electronic shelf label to an existing shelf label rail system.

The drawings are exemplary only, and depict various embodiments of the invention.

DETAILED DESCRIPTION OF THE INVENTION

An electronic shelf label assembly including a display and printable overlay on a support can be sold to retail outlets for use in displaying changeable merchandise information. Static merchandise information can be provided on the assembly by the overlay, while changeable information can be written on the display and viewed through a window of the overlay. The support assembly can be pre-tested prior to sale to ensure display functionality. The overlay can be printed by the retailer and affixed to a corresponding support. A

new overlay can be generated and affixed to the support if typically static information about the product changes. The term "static information" as used herein refers to product information which does not change often, for example, unit size, unit weight, product name, manufacturer name, trademark, UPC, bar code, or the like. Price changes can be made by updating the display electronically. The electronic shelf label assembly and methods of making it are described in detail with reference to the accompanying figures.

As shown in Figs. 1 and 2, a character display **10** can be constructed by forming a conductive common electrode layer **20** on a substrate **15**. The substrate can be any suitable material, for example, glass or plastic. When the substrate is plastic, it can be flexible, for example, a flexible self-supporting plastic film. "Plastic" means a polymer, usually made from polymeric synthetic resins, which can optionally be combined with other ingredients, such as curatives, fillers, reinforcing agents, colorants, and plasticizers. Plastic includes thermoplastic materials and thermosetting materials. Where a flexible plastic substrate is used, it can be reinforced with a hard coating, for example, an acrylic coating. The coating can have a thickness of from 1 to 15 microns, for example, from 2 to 4 microns. Various suitable hard coatings can be used, dependent upon the substrate material, and include a mixture of UV-cured polyester acrylate and colloidal silica, known as "Lintec" by Lintec Corporation of Tokyo, Japan, and an acrylic coating sold as Terrapin® by Tekra Corporation, New Berlin, Wisconsin.

The common electrode layer is a conductive layer. It can include one or more metal oxide. A primary metal oxide can be indium oxide, titanium dioxide, cadmium oxide, gallium indium oxide, niobium pentoxide, or tin dioxide, for example. A secondary metal oxide can also be in the conductive layer, and can be, for example, an oxide of cerium, titanium, zirconium, hafnium and/or tantalum. See, U.S. Pat. No. 5,667,853 to Fukuyoshi et al. Transparent conductive oxides that can be used include, but are not limited to, ZnO_2, Zn_2SnO_4, Cd_2SnO_4, $Zn_2In_2O_5$, $MgIn_2O_4$, Ga_2O_3--In_2O_3, or TaO_3. According to various embodiments, the common electrode layer can be tin-oxide, indium-tin-oxide (ITO), or polythiophene. The common electrode layer can be an opaque

electrical conductor formed of metal such as copper, aluminum or nickel. If the conductive layer is an opaque metal, the metal can be a metal oxide to create a light absorbing conductive layer. The common electrode layer can be formed by any known method, including low temperature sputtering techniques and direct current sputtering techniques, such as DC-sputtering or RF-DC sputtering, depending upon the material or materials of the underlying layer. The common electrode layer can be preferably patterned, for example, into a plurality of electrodes.

A layer of bistable liquid crystal material **25** can be deposited over at least a portion of the conductive common electrode layer **20**, leaving an exposed area **22** of the conductive common electrode layer **20**. Bistable liquid crystal material can be used so that the display requires no power to maintain its state once electronically written. Bistable display materials that can be used include, for example, cholesteric nematic liquid crystal such as disclosed in U.S. Pat. No. 5,695,682, and electrophoretic particles such as those manufactured by Gyricon, LLC of Ann Arbor, MI, and E-ink Corporation of Cambridge, MA. The bistable liquid crystal material **25** can be formed on the conductive common electrode layer **20** by roll coating, placement of a pre-formed layer, or any other means known to practitioners in the coating arts. Application of fields of various intensity and duration change the state of bistable materials from a reflective to a transmissive state. These materials have the advantage of maintaining a given state indefinitely after the field is removed. Examples of suitable cholesteric liquid crystal materials include, but are not limited to, Merck BL112, BL118 or BL126, available from EM Industries of Hawthorne, NY.

Electrically conductive character segments **35** can be formed over the bistable liquid crystal material layer **25** by thick film printing, sputter coating, or other printing means. The conductive character segments can be any known aqueous conductive material, for example, carbon, graphite, or silver. An exemplary material is Electrodag 423SS screen printable electrical conductive material from Acheson Corporation. The conductive character segments **35** can

be arranged to form numbers 0-9, a slash, a decimal point, a dollar sign, a cent sign, or any other alpha-numeric character or symbol.

A dielectric layer **30** such as deionized gelatin can be formed over the conductive character segments **35** by standard printing or coating techniques. Via holes **45** can be formed over each conductive character segment **35** by the absence of dielectric layer **30** over at least a portion of each conductive character segment **35**, or by removing a portion of the dielectric layer **30** over each conductive character segment **35**, for example, by ablation or chemical etching.

Electrically conductive traces **40** can be formed over the dielectric layer **30** by printing or coating techniques. One or more electrically conductive trace **40** can flow through a via hole **45** on formation, making electrical contact with the conductive character segments **35**. The conductive traces **40** can extend from character segments **35** to the exposed area **22** along a side of the display **10**, where the conductive trace **40** forms a contact pad **50** in exposed area **22**.

The contact pads **50** can be any conductive material, for example, silver or carbon. The conductive pads **50** can be formed with the conductive traces **40**, or separately therefrom. Conductive pads **50** that are not formed with the conductive traces **40** are coated on dielectric layer **30**. A via hole **45** extends from the conductive pads **50** through dielectric layer **30** to the common electrode layer **20**.. The exposed area **22** and the contact pads **50** thereon can be formed along one side of the display **10**, along multiple sides of the display **10**, or in one or more locations on the display not including a conductive character segment **35**. According to various embodiments, the contact pads **50** can be formed in exposed area **22** along one edge of the display **10**. The contact pads **50** can be placed linearly or grouped, such as in a pattern, for example, a square or rectangle, in an exposed area **22**.

The optical state of the bistable liquid crystal material **25** between the conductive character segment **35** and the common electrode layer **20** can be changed by selectively applying drive voltages to the corresponding contact pad **50** that is electrically connected to the conductive character segment **35** through a conductive trace **40** and to the electrode layer **20** by direct contact. Once the

optical state of the bistable material has been changed, it remains in that state indefinitely without further power being applied to the electrodes. Methods of forming the character display **10** are known to practitioners in the art, and are described, for example, in USSN 10/134,185, filed April 29, 2002 by Stephenson et al.

The character display **10** can be attached to a support **55**. Fig. 3 shows a frontal perspective view of an embodiment of the support **55**. The support **55** can be any suitable material, for example, plastic, glass, ceramic or the like. The support **55** can be shaped by any means known in the art. According to various embodiments wherein the support is plastic, the support **55** can be injection molded, press-molded, roll sheet, extruded, or the like. As shown in Fig. 3, the support **55** can have a plurality of conductive strips **70** inset within the support **55**, or formed along a surface of support **55**. Although conductive inlay strips are exemplified in Fig. 3, other forms of a conductive contact material can also be used in or on support 55, so long as the form of the conductive contact is electrically conductive and is capable of conveying such electrical charges to the conductive traces and common electrode layer of the display directly, or through the contact pad. For example, the conductive contact can be metal or a conductive plastic. It can be applied to the support by printing, as an appliqué, or other like techniques. The conductive contact can also be formed as part of the support, for example, by molding the conductive contact into the support.

According to various embodiments, the support **55** can be injection molded with conductive inlay strips **70** molded within it. The support **55** can have a recess **65** designed to accept printable overlay **100** for proper alignment of the overlay **100** onto the support **55**. The recess **65** can be of sufficient size to accommodate the overlay **100** or can be larger than the overlay **100**. The recess **65** can be of the same or a different shape as the overlay **100**. The support **55** can have one or more clearance recess **60** for receiving one or more character display **10**. Clearance recess **60** can be of sufficient size to enable the display **10** to adhere flatly onto support **55** in recess **60**. The display **10** can fit into clearance recess **60** such that the visible surface of the display **10** is co-planar or nearly co-

planar with either the surface of recess **65**, if present, or the surface of the support **55**. According to various embodiments, both recess **65** and clearance recess **60** can be present in support **55**, as shown in Fig. 3.

As exemplified herein, the support has a recess for receiving a display, and a recess for receiving a printable overlay. The recesses provide advantages including clear indication of attachment points for the display and overlay, and provision of a planar or nearly planar surface on the shelf tag assembly. The attachment point for the display can be indicated by the recess as described; by a raised area of the support within which the display can be positioned; by a physical indication of the display area, for example, by a depression or raised area of the support immediately surrounding the display area, including tabs or lines; by visual marks, for example, at least a portion of a printed outline; or by placement of the electrical contacts. The attachment area for the overlay can be indicated by the recess as described; by a raised area of the support within which the display can be positioned; by a physical indication of the display area, for example, by a depression or raised area of the support immediately surrounding the display area, including tabs or lines; by visual marks, for example, at least a portion of a printed outline; or by alignment of the window of the overlay with the display.

The character display **10** can be attached to the conductive strips **70** of the support **55** through contact pads **50** with an adhesive. The adhesive can be in the form of a paste, sheet, layer, solvent coating, or the like, and can be coated on or adhered to the conductive strips **70**, the contact pads **50**, or both. According to various embodiments, the adhesive is a conductive adhesive. The conductive adhesive can be anisotropic. Fig. 4 depicts a front view of support **55** with conductive strips **70**, having strips of conductive adhesive tape **75** applied over the conductive inlay strips **70**. Conductive adhesive tape **75** can be applied with a backer liner **80** on one side, such that the adhesive tape **75** is not exposed. Backer liner **80** can be removed to expose conductive adhesive **75** for adhesion to the conductive contact pads **50** of character display **10** as the display **10** is attached to support **55**. Placement of the conductive adhesive **75** between conductive contact

pads **50** on display **10** and conductive inlay strips **70** provides electrical continuity between the conductive character segments **35** in character display **10** and the conductive inlay strips **70**. According to various embodiments, the conductive strips **70** can be in direct physical contact with the contact pads **50**.

Fig.5 illustrates a completed support assembly **110** having display **10** inserted into the support **55** such that each contact pad (not shown) of the display **10** is conductively connected to an inlay strip **70**. The conductive inlay strips **70** are exposed on a surface of support **55** to allow electronic programming of the changeable conductive characters segments **35** on display **10**. A printable overlay can be placed on support assembly **110** to provide static information.

A printable overlay can be supplied in any suitable printable form, for example, as individual printable labels, as a printable roll of multiple separable overlays, or in sheet form. The printable overlay can be any material suitable for printing, for example, paper or plastic. A plastic printable overlay can be transparent or opaque. An opaque overlay of paper or plastic can be any color. Fig. 6 shows a printable sheet **85** having a plurality of printable overlays **100**. According to various embodiments, a printable sheet **85** can include one or more overlay **100**. According to various embodiments, the printable sheet **85** can include an adhesive backing **90** and an adhesive backer liner **95**, as shown in Fig. 6, such that the overlays can be adhered to support assembly **110** by an adhesive backing **90**. According to various embodiments, each overlay **100** can be attached to support assembly **110** non-adhesively by use of a retainer, for example, tabs, slots, clips, brackets, or pegs on support **55** into or onto which the overlay **100** can be placed, respectively.

Each overlay **100** can have one or more window **105** corresponding to a position of a display **10** when the overlay **100** is placed on support assembly **110**. The window **105** can allow all or only a portion of display **10** to be viewed. The windows **105** can be perforated or die cut through the printable sheet **85**. According to various embodiments, the perforation or die cut can also extend through the adhesive backer liner **95** when present. Each printable overlay **100** can be die cut or formed by perforations through the printable sheet **100**. The

printable overlay **100** can have readable static information **120**, for example, a bar code and/or item description, applied by printing. Printing can be performed by any known method, including but not limited to inkjet printing, thermal printing, electrophotography, and manual printing, for example, hand-lettering. The printed inks or colorants can be chosen for contrast to the overlay color.

According to various embodiments, the window in the overlay can be a transparent material, for example, a polymeric material or cellophane, that is adhesively secured to the overlay and capable of passing through a printer without damage, such as crinkling or melting of the transparent window. According to various embodiments, the entire overlay can be a transparent, printable material through which the display can be viewed. Where the entire overlay is transparent, the printing on the overlay should contrast the color of the support. For example, if the support is white, the print on the transparent overlay can be black, blue, red, green, or any color other than white. If the support is black, the print on the transparent overlay can be white, yellow, or any other contrasting color readable on a black background. A transparent window material can protect the display from environmental hazards and damage by touch.

Fig.7 is an exploded view of a shelf label assembly **115.** The shelf label assembly **115** is shown with printable overlay **100** having an adhesive backing **90**, wherein the printable overlay **100** has been separated from the adhesive backer liner **95** of printable sheet **85** and is ready for attachment to the support assembly **110**.

A cross-sectional exploded view of the shelf label assembly **115** along line 8-8 of Fig. 7 is depicted in Fig. 8. As shown in Fig. 8, the printable overlay **100** can overlap at least a portion of the display **10**. The contact pads **50** can overlap at least a portion of the conductive adhesive **75**, by which they are conductively attached to the conductive inlay strips **70**. The display **10** and conductive adhesive can fit within recess **60**, and the printable overlay **100** can fit within recess **65** of the support **55**.

Fig. 9 is a front view of a completed shelf label assembly **115**. At least a portion of the conductive inlay strips **70** are exposed on the support **55**

outside the area covered by the printable overlay **100** to allow electrical contact through the strips **70** to the display. Fig. 9 demonstrates a possible placement of static information **120**, a UPC, on the printable overlay **100**. Information can be printed anywhere on the printable overlay, and can include multiple types of information, for example, a UPC, product number, weight, size, store code, manufacturer, product name, trademark, image, and the like. Temporary information can also be printed on the printable overlay, with the understanding that a new overlay will be required when such information changes. The overlay **100** is shown in Fig. 9 as covering most of the support **55** on the side from which the display is visible. The overlay **100** can cover a portion of the support **55** adjacent the display **10**. A secondary overlay can be printed to cover another portion of the support **55** not including the display **10**, or to cover or update information on the overlay **100** that has changed, thereby foregoing the need to print and attach a new overlay over or in place of an existing overlay **100**.

The shelf label assembly can be attached to a shelving unit through the support. Various shelving attachments include a clip; a tab; a bracket; a fastener, for example, a screw, nail, or adhesive; or any other attachment method known for securing two items. Where a physical retainer such as a tab, clip, or bracket is used, the physical retainer can be formed as, or attached to, part of the support, and can interact with the shelving unit. The physical retainer can be formed as or attached to part of the shelving unit, and interact with the support of the shelf label assembly. Fig. 10 shows a rear perspective view of shelf label assembly **115**, wherein a bracket **125** is formed on the support **55** for attachment to an existing shelf tag rail system.

The shelf label assembly can be used in a retail or storage environment to provide product information which can be changed as needed by rewriting the display, changing all or a portion of the overlay, or a combination thereof. In use, one or more displays can be attached to a support as indicated on the support, a printable overlay can be printed with information, the overlay can be applied to the support including the one or more display, and the display can be written by electrically activating various display segments through the conductive

inlay strips on the support. The support can be attached to a shelving unit or other display unit for viewing of the information on the display and overlay.

The invention has been described in detail with particular reference to certain preferred embodiments thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention.

PARTS LIST

10	display
15	substrate
20	common electrode layer
22	exposed area
25	bistable liquid crystal layer
30	dielectric layer
35	conductive character segment
40	conductive traces
45	via holes
50	tag contact pad
55	support
60	recess in support for tag
65	recess in support for printable overlay
70	conductive inlay strips
75	conductive adhesive strip
80	conductive adhesive backer liner
85	printable sheet
90	adhesive backing
95	adhesive backer liner
100	printable overlay
105	perforated window
110	support assembly
115	shelf label assembly
120	static information
125	bracket